NETWORK MANAGEMENT SYSTEM

FIELD OF INVENTION

[0001] The present invention relates to the field of network management systems, especially to a network management system for an optical transport network.

ART BACKGROUND

[0002] The field of technology is related to the management of optical networks, i.e. dense wavelength division multiplexing (DWDM) networks, especially to the management of the flexible multiplex structures and the electrical switching.

[0003] In new generation DWDM networks, several transport container (transmission layer) exist, i.e., optical channel data units ODUk with k=0 to 4, which can be multiplexed to each other without the need to follow fix containments and multiplex structures. That is, each ODUk (for instance k=1-4) can be multiplexed into each ODUk+n in any arbitrary order. The number of ODUk container as well as the possible containments (or client server relationships) increase constantly in the same way as the bandwidth increases which can be transmitted via an optical channel, e.g. 1 Gbit/sec→ODU0, 2.5 Gbit/sec→ODU1, 10 Gbit/sec→ODU2, 40 Gbit/sec→ODU3, 100 Gbit/sec→ODU4, ...

[0004] An ODUk can contain all ODUk−n (low order ODU, LO-ODU). The LO-ODU can be of the same layer only or mixed in each possible combination. However the overall bandwidth can be used only once, i.e. the load of one ODU3 is adequate to e.g. 4×ODU2 or 16×ODU1 or 32×ODU0. In addition, at least until now, ODU2/3e and ODUflex exist. For ODUflex, the bandwidth can be modified (increased/decreased) from 2.5 G/sec to 100 G/sec and multiplexed to each higher order ODUk (HO-ODUk) with k=2-4. That means that no fix multiplicity and relationship to the other ODUk layer can be defined. For instance, the containment in a ODU4 could be ODU1, ODU0, ODU0, ODU3, ODU3e, ODU2, ODU2e, ODUflex, . . . in each possible sequence of all possible ODUks.

[0005] In addition, the multiplexing cannot only be single stage but multistage, i.e. an ODU0 can be multiplexed into an ODU1, the ODU1 again into an ODU2, the ODU2 again into an ODU3 and the ODU3 again into an ODU4.

[0006] Due to the high flexibility to define the multiplex structure and the fact that the structure has not to be defined completely in one step but can be enhanced each time when a new service is to be configured in the network, it might be nearly impossible to offer the user any prepared templates for all possible multiplex structures which are possible—especially for ODU3 and above. The amount of selectable structures is very high, specially, if the possible combinations of the time slot usage in dependence on the payload type are considered. For instance, the possible combinations of ODU3 in an ODU4 can be seen from the following formula:

$$\binom{80}{20} = \frac{80!}{32!18!} = 2.19e^{22}$$

[0007] Even in case any system could handle this huge amount of combinations, it is very uncomfortable a user to handle it (like finding right template in a very long list).

[0008] In common networks, the multiplex structures were well defined and could be changed only according to fix rules and multiplicities. That means that the possible multiplex structures were limited and therefore easy to handle by the network management system and the user. As the flexibility is increasing, there may be a need for an improved system and method providing a flexible and dynamic management for a dynamic multiplexing structure.

SUMMARY OF THE INVENTION

[0009] This need may be met by the subject matter according to the independent claims. Advantageous embodiments of the present invention are described by the dependent claims.

[0010] According to a first aspect of the invention there is provided a network management system for a transport network, wherein services are transmittable via the transport network by using at least one of a plurality of containers, wherein each of the containers is adapted to transmit data with a specific bandwidth, wherein each of the plurality of containers is multiplexable, according to a dynamic multiplexing structure, to at least another container being adapted to transmit data with a higher bandwidth. The network management system comprises a selection unit being adapted to select a container being adapted to transmit data with a first bandwidth out of the plurality of containers, a determination unit being adapted to determine all (possible) containers of the plurality of containers being adapted to transmit data with a bandwidth lower than the first bandwidth, a definition unit being adapted to define all possible termination points (TP) for each determined container, wherein the definition unit is adapted to define all possible termination points before a service to be transmitted is selected by a user, and a subselection unit being adapted to select a number of the possible termination points for each determined container based on a selection scheme in order to provide the selected number of the possible termination points to the user.

[0011] The described network management system may be applicable to networks technologies like Ethernet, Virtual LAN (VLAN) or Multiprotocol Label Switching (MPLS).

[0012] "Container" in this context may denote any kind of function being provided by the network technology for transmitting data.

[0013] In the following, the network management system will be described in further detail with respect to an optical transport network using optical channel data units (ODUs) as container. However, it should be noted that all embodiments being described in the context of such an optical transport network may also be used in the context of other network technologies like Ethernet, VLAN or MPLS or any other network technology. The embodiments being described in the context of ODUs are thus not limited to the specific form of an optical transport network and ODUs but may be transferred to other network technologies.

[0014] According to an embodiment of the invention, the transport network is an optical transport network, and wherein the plurality of containers is a plurality of optical channel data units.

[0015] That means that services are transmittable via the optical transport network by using at least one of a plurality of optical channel data units, wherein each of the optical channel data units is adapted to transmit data with a specific bandwidth, wherein each of the plurality of optical channel data units is multiplexable, according to a dynamic multiplexing structure, to at least another optical channel data unit being adapted to transmit data with a higher bandwidth. This further means that the selection unit is adapted to select an optical